ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM

Plant Abstract **Element Code:** PDFAB0F9Z0
Data Sensitivity: No

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Astragalus holmgrenorium* Barneby
COMMON NAME: Holmgren Milk-vetch, Paradox Milk-vetch
SYNONYMS:
FAMILY: Fabaceae (Leguminosae)

AUTHOR, PLACE OF PUBLICATION: Barneby, Brittonia 32(1): 24-26, f. 1. 1980.

TYPE LOCALITY: "Arizona: Mohave Co., Mokiah Wash drainage…. E of Mokiah Pass road …. S of the Utah border; 850 m; 25 May 1979."

TYPE SPECIMEN: HT: NY N.H. Holmgren, P.K. Holmgren and R.C. Barneby #9175, 25 May 1979. IT: BRY, UTC.

TAXONOMIC UNIQUENESS: A member of the pea family, the genus *Astragalus* is the largest genus of vascular plants world-wide. The genus contains over 2,000 species distributed throughout the world although they are primarily found in the northern hemisphere (Barneby 1989 and Zomlefer 1994, cited in USFWS 2006). Many species of Astragalus are narrow endemics, while relatively few are widespread.

DESCRIPTION: A dwarf, tufted, strictly acaulescent (stemless) herbaceous perennial that produces leaves and small purple flowers in the spring and dies back to its roots after the flowering season. Compound leaves are pinnate, 4-13 cm (1.6-5.1 in) long, arise from a thickened root crown and taproot, and are mostly pressed close to the ground; leaf stems prostrate. They have 9-15 leaflets that are 0.8-1.6 cm long, broadly obovate-emarginate to obcordate, and are pilose below and glabrous above; herbage is green. Caudex is simple, and not obscured by the persistent leaf bases. Flowers are pinkish-purple with unique white-tipped wings, 1.8-2.4 cm long and 0.6-0.9 cm wide and have the flower shape of a legume, i.e., pea-like flowers with five petals that include a large petal on top enclosing two lateral petals and two smaller lower petals. The plant has a raceme inflorescence with, typically, 6 to 16 flowers. The peduncle is 2.0-8.5 cm (0.8-3.4 in) long, arising directly from the root crown and is erect during anthesis and prostrate when the plant is in fruit. The fruits are pods 3-5 cm (1.2-2.0 in) long and 0.6-0.9 cm wide. The pods are thick, bilocular, trigonously compressed, and keeled below. The pods retain seeds even after they fully open up along the margin; with age, each pod eventually dries out and opens up at both the top and bottom ends. Pods can contain up to 38 seeds (Falk, Jenkins et al. 2001; Utah Native Plant Society 2003-2006; USFWS 2006a, Rominger et al. 2019).

AIDS TO IDENTIFICATION: Only true stemless *Astragalus* with trigonously compressed, bilocular pod that disjoints from the receptacle prior to dehiscence. Leaves pilose below, glabrous above and dark green.

ILLUSTRATIONS: Line drawing (USFWS; USFS 1991, Atwood et al).
Line drawing of type (NY 5457, NYBG ….)
Color photos of plant and habitat (Lee Hughes (BLM), *in* Falk, Jenkins et al. 2001)
Color photo (D. Atwood, *in* Utah Native Plant Society 2003-2006)
Color photo of habitat (K. Harper, *in* Utah Native Plant Society 2003-2006)
Color photo (R. Van Buren, p. 3, f. 1, *in* USFWS 2006)

TOTAL RANGE: Total known range consists of a few square km on the Arizona/Utah border, in Mohave County, Arizona and Washington County, Utah (St. George, Utah Basin).

RANGE WITHIN ARIZONA: Extreme northern Mohave County near Virgin River gorge, near the Arizona-Utah border.

SPECIES BIOLOGY AND POPULATION TRENDS

GROWTH FORM: Herbaceous perennial. Per Hughes (1999), "Biennial really. In my plot, I changed tags every two years."

PHENOLOGY: Flowers March and April; fruiting April (Falk, Jenkins et al. 2001). Utah Native Plant Society (2003-2006) reports flowering April - May. *A. holmgreniorum* does not appear to be capable of vegetative reproduction; thus, the setting of seed is necessary for future offspring.

A phenological study conducted over two years over the course of two growing seasons concluded that peak flowering occurs in early April, regardless of weather variation (Rominger et al. 2019). One of the study sites was the Gardner Well subpopulation, within Arizona. Furthermore, this study found that while the plants vital rates were only weakly correlated with winter-spring total precipitation, within-season variation in precipitation and temperatures had significant effects on growth, survival and reproductive measures including fruit set, seed set, and seedling survival. They also documented that either plant death or dormancy induction was related to daytime temperatures above 30°C. Seedling emergence appears to be related to precipitation events, while adult plant reemergence appears to be related to warming temperatures during the spring (Rominger et al. 2019). Overall, this study found that the timing of precipitation events was as important as overall precipitation levels on seedling survival.

BIOLOGY: *Astragalus holmgreniorum* is a short-lived perennial with low survivorship from germination to 1-year-old juvenile or reproductive adult. Few plants live past two growing seasons (Stubben 1997 and Van Buren and Harper 2003, cited in USFWS 2006). The best time to detect species is while it is producing flowers and fruit. Solitary bees are the primary pollinators of this plant, with *Anthophora poterae* (widespread bee in western U.S.) the plant's most frequent visitor (Tepedino 2005, cited in USFWS 2006). Other pollinators include *Anthophora coptognatha, A. dammersi, Eucera quadricincta, O smia titusi,* two *Dialictus* species, an undetermined *Anthophora* species, and the introduced honeybee (*Apis mellifera*), (Tepedina 2005, in USFWS 2006). Seeds are thought to be dispersed by water, as the plants are generally found on the skirt edges of washes or in run-off channels around mounds (Van Buren and Harper 2004a, cited in USFWS 2006). Rodents and smaller, ground-dwelling birds are other likely dispersal agents (S.L. Welsh, pers. comm. 2005, in USFWS 2006).

HABITAT: This species is typically found on the skirt edges of hill and plateau formations slightly above or at the edge of drainage areas, where the cover averages less than 15% of the landscape (USFWS 2006). It grows in draws on gravelly clay hills, where water runoff occurs, at upper edge of *Larrea* zone (Mokiah Wash drainage). Associated with *Lycium andersonii*.

ELEVATION: This species inhabits elevations from 2,480-2,999 ft (756-914 m), in areas that drain to the Santa Clara and Virgin rivers (USFWS 2006). In Arizona, they can be found from 2,700 - 2,800 ft. (823-854 m).

EXPOSURE: Southerly. Collected on SW slopes of 5-10% (ARIZ 227948).

SUBSTRATE: Well drained shallow gravelly loams; alluvial fans and rock outcrops. Associated with geological layers or parent materials found within the Moenkopi formation. Collected on rocky clay loam (ARIZ 225981).

PLANT COMMUNITY: At the landscape level, the dominant plant community is described as Sonora-Mojave Creosotebush-White Bursage Desert Scrub (NatureServe 2003) and, alternatively, as Mohave Mixed Shrub and Mohave Creosote/Bursage habitats (Bennett et al. 2004). (USFWS 2006). Falk, Jenkins et al. (2001) reported community type as Great Basin shrub community. Associated native plants include: perennial shrubs such as *Acamptopappus sphaerocephalus* (desert goldenhead), *Ambrosia dumosa* (white burrobush), *Ephedra nevadensis* (Nevada jointfir), *E. torreyana* (Torrey's jointfir), *Krameria parvifolia* (range ratany), *Lycium andersonii* (Anderson wolfberry), *Gutierrezia microcephala* (threadleaf), and *G. sarothrae* (broom snakeweed). Native forbs and grasses include: *Astragalus nuttallianus* (small flowered milk-vetch), *Chaenictus carphoclina* and *C. stevioides* (dusty-maiden species), and *Hilaria rigida* (big galleta) (Van Buren and Harper 2003a, 2003b, 2004a, cited in USFWS 2006). Other associated plants reported include: *Amphipappus, Ceratoides lanata, Eriogonum inflatum*, *Haplopappus,* and *Larrea*. (NYBG Virtual Herbarium 2006, SEINet, accessed 2006).

With historical and ongoing land disturbance, forb associates include the introduced weedy species *Bromus rubens* (red brome), *B. tectorum* (cheatgrass), *Erodium cicutarium* (storksbill), and *Malcolmia africana* (African mustard) (several authors cited in USFWS 2006).

POPULATION TRENDS: Per Hughes (1999), counts of adult plants on plot were as follows, 1988: 177; 1989: 135; 1990: 0; 1991: 74; 1992: 283; 1993: 179; 1994: 38; 1994: 43; 1998: 1; 1999: 1. Trend is down.

According to Van Buren and Harper (2003), "The number of living plants perhaps never exceeds 10,000. In drought years, *A. holmgreniorum* populations are as much as 95% smaller than in years with adequate water, and few plants produce flowers that successfully contribute to the seed banks."

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS:	Listed Endangered (USDI, FWS 2001) With Critical Habitat (USDI, FWS 2006) Recovery Plan (U.S. FWS 2006) [Candidate USDI, FWS 1996] [Category 1 USDI, FWS 1993] [Category 2 USDI, FWS 1990, 1985, 1983]
STATE STATUS:	Highly Safeguarded (ADA, ANPL 2016, 1999, 1993)
OTHER STATUS:	Bureau of Land Management Sensitive (USDI, BLM AZ 2017, 2000) [Not Bureau of Land Management Sensitive (USDI, BLM AZ 2005)]

MANAGEMENT FACTORS: The foreseeable threat with the greatest impact is habitat degradation/loss. Also threatened by highway and power line construction, urban development, ORV use, displacement by exotic weeds, grazing, and mineral development (Harper 1997 and Stubben 1997, cited by USFWS 2000, in NatureServe 2006). Populations in both states are in areas valued for future urban expansion. If critical habitat is established on Arizona Strip FO lands, these lands will be retained in Federal ownership, protecting it from development. However, the ESA does not provide protection for any lands in Private ownership.

They key recovery solution for *A. holmgreniorum* (along with *A. ampullarioides*) is protection of occupied and suitable habitat through fee title purchases, conservation easements, and designated open spaces, and management of these properties as plant preserves.

This species' continued survival at occupied sites despite high plant mortality appears to be related to its high reproductive output and a persistent seed bank (Rominger et al. 2019).

PROTECTIVE MEASURES TAKEN: Critical Habitat designated for 3 units in Arizona and Utah; Unit 1 occurs in Arizona, with 2 of the 3 subunits (State Line and Gardner Well) within Mohave Co., Arizona (USFWS 2006b). Units 2 and 3 are found in Washington Co., Utah.

SUGGESTED PROJECTS: Research needs to be conducted to answer a couple of questions as posed in the USFWS 2006 Recovery Plan – "Why has *A. holmgreniorum* not colonized what appears to be appropriate existing habitat, and what needs to be known in order to address expansion as an appropriate solution." Other needs outlined in the recovery plan include the development of a rangewide monitoring plan and protocol, creation of a database for long-term collection and evaluation of monitoring data, delineate appropriate potential habitat areas and conduct surveys on Federal lands, and create a spatial database for survey efforts, including negative results. Additional needed investigations include: nonnative weeds, pollinators, habitat substrates and soil conditions, fire effects, genetic variation within and among populations, seedbank viability and longevity, and parasitism and/or disease.

LAND MANAGEMENT/OWNERSHIP: BLM – Arizona Strip and St. George Field Offices; Arizona and Utah State Land Departments.

SOURCES OF FURTHER INFORMATION

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ADDITIONAL INFORMATION:

Initial recovery solutions for *A. holmgreniorum*, based on the 2006 Recovery Plan, "will center on taking the necessary measures to ensure that the species' current status does not further deteriorate, which hinges on the overriding need to address both imminent and long-term population losses caused by expanding land development and land use activities in the region… The top recovery priority will be given to, first, maintaining the current number of populations at a size and distribution indicative of the species' population dynamics and known range, and, second, conserving the habitat of these populations and their pollinators. This will require appropriate resolution of threats involving habitat loss and land degradation, as well as actions to fully compensate for unavoidable impacts to extant populations."

As for the possibility of artificially establishing new populations, a conservation tool that remains untested for *A. holmgreniorum*, "any population repatriation attempts at this early stage of recovery will be regarded as strictly experimental, and introduced populations will not compensate for impacts on extant populations, nor will they count toward meeting recovery objectives unless and until we are certain they will remain viable over the long term. If repatriation becomes a key component of recovery, then a rangewide repatriation becomes a key component of recovery, then a rangewide repatriation strategy will be developed." (USFWS 2006).

Revised: 1995-06-06 (DBI)
1999-12-20 (DJG)
2000-03-24 (LEH)
2006-10-06 (SMS)
2022-02-15 (TME)

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Arizona Game and Fish Department. 20XX **(= year of last revision as indicated at end of abstract)**. X...X **(= taxon of animal or plant)**. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. X pp.